REMARKS

Claims 1, 3, 5, 7 to 11, 13 to 16, 18, 20 and 21 are all the claims pending in the application.

The Examiner has indicated that claims 7-10 and 21 are allowable over the prior art of record.

The Office Action Summary page indicates that all of the claims have been rejected. However, the Examiner states at page 4 that the claims 7-10 and 21 are allowable. Accordingly, applicants' undersigned attorney called the Examiner to confirm that the Office Action Summary page contains an error, and that claims 7-10 and 21 are, in fact, allowable. The Examiner confirmed that these claims are allowable.

Applicants have amended claim 11 to place it in better form.

Claims 1, 3, 5, 11, 13-16, 18 and 20 have been rejected under 35 U.S.C. § 103(a) as obvious over WO 00/58536 to Nishimura et al, whose English language equivalent is U.S. Patent 6,489,026 to Nishimura et al.

Applicants submit that Nishimura et al do not disclose or render obvious the subject of claims 1, 3, 5, 11, 13 to 16 and 20 and, accordingly, request withdrawal of this rejection.

The present invention as set forth in claim 1 is directed to an electrical insulating vapor grown carbon fiber having a fiber diameter of 0.01 to 0.5 μm, a hollow part in the center of the fiber and a boron concentration of about 1 to about 30% by mass in terms of a boron element, wherein the surface thereof is partially or entirely coated with an electrical insulating material of boron nitride and the amount of boron in a depth of 1 nm from the surface of the vapor grown

carbon fiber is about 10% by mass or more, based on the entire mass of the vapor grown fiber having a depth of 1 nm from the surface, and wherein the electrical insulating vapor grown carbon fiber has a specific resistivity of 10^3 Ω•cm or more when compressed at a bulk density of 0.8 g/cm^3.

Each of the rejected independent claims in the present application, namely, claims 1, 11 and 16 recites an electrically insulating material of boron nitride as a coating and recite that electrical insulating vapor grown carbon fiber has a specific resistivity of 10^3 Ω•cm or more when compressed at a bulk density of 0.8 g/cm^3.

A distinguishing feature of the present invention is that the electrical insulating material is boron nitride. Thus, as can be seen in Table 1 at pate 15 of the present application. Comparative Example 2 of the present application, which employed argon as the inert gas, and which did not form boron nitride, had a resistivity of 0.005 Ω•cm, whereas, Example 1, which employed nitrogen as the inert gas and formed boron nitride, had a resistivity of 1 x 10^4Ω•cm.

As set forth in the Amendment Under 37 C.F.R. § 1.111 filed on March 29, 2005, Nishimura et al disclose the addition of boron or a boron compound to vapor-grown carbon fibers (VGCF). Nishimura et al disclose a number of different boron compounds, among which is boron nitride, but do not contain a specific example of the use of boron nitride, and do not disclose or suggest that a coating of an electrically insulating material of boron nitride is formed. Thus, the disclosure of boron nitride in Nishimura et al does not satisfy the recitations in the present claims of a partial or entire coating of an electrical insulating material of boron nitride.

In particular, in Nishimura et al, VGCF and a boron compound are mixed (not necessarily uniform mixing) and heated at 2,000°C or more in an inert gas atmosphere. As a result, B enters

into a graphen sheet of VGCF, whereby the crystallinity of graphite and, in turn, the electrical conductivity and thermal conductivity of VGCF are enhanced. The only inert gas disclosed in Nishimura et al is Ar.

The boron compound used as the boron source in Nishimura et al decomposes into B and others when heated at a high temperature of 2,000°C or more. By the entering of B produced upon decomposition into a graphen sheet of VGCF, the crystallinity of graphite is enhanced. At this time, any B that does not enter into the graphen sheet of VGCF reacts with VGCF or with carbon that does not constitute VGCF and which is present as an impurity, and forms B_4C.

In the case of an Ar inert gas atmosphere as in Nishimura et al, B forms a compound only with carbon, and O or N in the boron compound, such as B_2O_3 and BN, is diluted with the Ar gas and does not remain as VGCF or as a boron compound. Thus, Nishimura et al do not disclose or suggest a coating of an electrical insulating material of boron nitride.

In fact, Nishimura et al are directed to providing a vapor grown carbon fiber that has an increased electrical conductivity, and are not directed to an electrical insulating vapor grown carbon fiber that has the specific resistivity set forth in the present claims. See, for example, column 1, lines 56 to 61, column 2, lines 4 to 6, column 2, lines 16 to 21, column 2, lines 40 to 60, column 3, lines 10 to 13, column 4, lines 18 to 21, and column 10, lines 46 to 48. See also Examples 4, 5 and 6 of Nishimura et al where the carbon fibers are shown to lower the resistance, that is, to increase conductivity. In Example 6, the Nishimura et al carbon fibers were employed in a negative electrode to lower the resistance, that is, to increase conductivity. Further, Nishimura et al specifically disclose at column 10, lines 46 to 48 that "the electrical conductivity increased to 0.01Ω.cm or less, specifically 0.003Ω.cm." Thus, Nishimura et al are

concerned with providing a vapor grown fiber having an increased electrical conductivity, and is not concerned with electrical insulating vapor grown fiber.

Further, applicants point that Table 2 at columns 14 and 15 of Nishimura et al disclose the "powder resistances" of the boron-containing carbon fibers produced in an argon atmosphere in Examples 4 and 5 of Nishimura et al. The powder resistance values in Table 2 of Nishimura et al for the boron-containing fibers are from 0.002 to 0.003Ω.cm, and appear to be similar to the resistivity of Comparative Example 2 of the present application, and not in accordance with the requirements of claims 1, 11 and 16.

In contrast to Nishimura et al, the present invention provides a coating of an electrical insulating material of boron nitride. Such a coating is achieved, for example, as the result of the use of an atmosphere that is not disclosed in Nishimura et al. For example, when N_2 is used as the atmosphere gas, since N_2 has reactivity at high temperature, B that does not enter into the graphen sheet of VGCF reacts with N_2, and forms a BN film on the VGCF surface, whereby an insulating VGCF is obtained. Also at this time, the crystallinity of graphite is enhanced by virtue of entering of B into the graphen sheet of VGCF and therefore, the Co value of VGCF itself becomes small. As a result, the thermal conductivity of VGCF is enhanced. However, since an insulating BN layer is formed on the VGCF surface, an insulating VGCF results.

Other than N_2, a compound containing nitrogen or capable of generating nitrogen can also form BN layer on the surface and, for example, ammonia or urea can be used. See page 8 of the present specification.

The Examiner recognizes that Nishimura et al do not disclose the use of nitrogen as an inert gas, but takes the position that inert gases of nitrogen and argon are obvious variants over

one another. As can be seen from the above discussion, however, nitrogen and argon are not equivalent to each other, and function in a different manner from each other. Nishimura et al nowhere disclose or suggest forming a boron nitride electrical insulating material on a vapor grown fiber, and there is no teaching or suggestion in Nishimura et al to employ nitrogen or any other nitrogen compound to form a boron nitride electrical insulating material on a vapor grown carbon fiber.

Beginning at the bottom of page 2 of the Office Action, the Examiner sets forth her response to arguments that applicants submitted in the Amendment of March 29, 2005.

The Examiner states that in view of the similarity in the method of making the vapor grown carbon fibers (VGCF), and in the absence of factual evidence, the Examiner has reason to believe that some of the boron nitride of Nishimura et al would be located on the surface of the VGCF as required by claims 1, 11 and 16.

In response, applicants point out, as discussed in detail above, that the methods are not similar. The Examiner has not identified the differences in the method, and has not set forth any comments or analysis of how these differences would be expected to affect the products that are produced. Applicants submit that the Examiner's assertion are based on mere speculation and hindsight reasoning.

The Examiner further states that the boron nitride of the present invention is an "electrically insulative material". The Examiner asserts that boron nitride is known as being both insulated and conductive. The Examiner states that there is no clear factual evidence in this record that the vgcf with boron nitride of the prior art does not result in some degree of insulative properties.

In response, applicants point out, as discussed above, that Nishimura et al disclose throughout their patent that they are directed to an increase in electrical conductivity, which is opposite from the electrical insulating fiber of the present invention. See, for example, column 1, lines 56 to 61, column 2, lines 4 to 6, column 2, lines 16 to 21, column 2, lines 40 to 60, column 3, lines 10 to 13, column 4, lines 18 to 21, and column 10, lines 46 to 48. See also Examples 4, 5 and 6 of Nishimura et al, where the carbon fibers are shown to lower the resistance, that is, to increase conductivity. In Example 6, the Nishimura et al carbon fibers were employed in a negative electrode to lower the resistance, that is, to increase conductivity.

Further, applicants again point that Table 2 at columns 14 and 15 of Nishimura et al disclose the "powder resistances" of the boron-containing carbon fibers produced in an argon atmosphere in Examples 4 and 5 of Nishimura et al. The powder resistance values in Table 2 of Nishimura et al for the boron-containing fibers are from 0.002 to 0.003Ω.cm, and appear to be similar to the resistivity of Comparative Example 2 of the present application, and not in accordance with the requirements of claims 1, 11 and 16.

Applicants submit that Table 2 of Nishimura et al disproves the Examiner's position that there is no clear evidence that Nishimura et al would not obtain the specific resistivity that is set forth in the present claims. Thus, the powder resistance in Table 2 of Nishimura et al of 0.002 to 0.003Ω.cm does not satisfy the recitation of the present claims of a specific resistivity of $1x10^3$Ω.cm or more.

Since Nishimura et al do not disclose the resistivity that is set forth in the present claims 1, 11 and 16, applicants submit that these claims, and the claims dependent therefrom, are patentable over Nishimura et al.

The Examiner also states that the vgcf having the requisite resistivity of claims 1, 11 and 16 is not necessarily limited to or specified as vgcf with a boron content, or vgcf with a boron nitride coating.

In response, applicants point out Nishimura et al do not disclose or suggest VGCF having the claimed resistivity. Further, the present claims recite a boron nitride coating and a boron content in a depth of 1nm from the surface of the vapor graon carbon fiber.

The Examiner acknowledges that applicants have argued that the only inert gas disclosed by Nishimura is Ar, that B forms a compound only with carbon, and O or N in the boron compound is diluted with the Ar gas and does not remain as vgcf or as a boron compound and, therefore, Nishimura et al do not disclose or suggest a coating of an electrical insulating material of boron nitride.

In response to this argument, the Examiner states that claims 1, 3, 5, 11, 13-16, 18 and 20 are directed to the product, and not the method of making the product. The Examiner states that the arguments with respect to the process of making the product, therefore, are not relevant to the claims drawn to the product.

In response, applicants point out that the arguments with respect to the process are relevant to the product claims because Nishimura et al do not disclose a process that will result in the product of the present claims. Since the process suggested by Nishimura et al will not produce the product set forth in the present claims, Nishimura et al do not suggest the present product claims. Further, as discussed above, Nishimura et al do not disclose or suggest the specific resistivity of the present claims and are directed to increasing electrical conductivity.

In addition, the Examiner states that there is no clear factual evidence of record that clearly substantiates applicants' allegation concerning the difference in the method of making the product. The Examiner states that she has reason to believe that some boron nitride is present on the fiber surface, and asserts that the requirement of "wherein the surface thereof is partially or entirely coated" as set forth in the claims includes nominal (small) amounts of coating.

In response, applicants point out, as discussed in detail above, that the methods are not similar. Moreover, the electrical insulating vapor grown carbon fiber as set forth in the present claims has a specific sensitivity of 10^3 Ω.cm or more when compressed at a bulk density of .08 g/cm^3. There is no teaching or suggestion in Nishimura et al to provide an electrical insulating vapor grown fiber with such a specific resistivity.

Further, as shown in the working Examples of the present invention (Table 1), after adding B_4C, and then conducting a heat treatment of more than 2,000℃ with N_2, the resistivity of the powder of VGCF is increased, thereby showing an insulating effect. However, when N_2 was replaced with Ar in Comparative Example 2, or B_4C was not added as in Comparative Example 1, the resistivity is small, thereby showing a conductive effect. Thus, the examples show that B and N are necessary in the present invention.

In the working example of Nishimura et al, BN is not used for the boron compound.

However, since it is stated in Nishimura et al that BN can be used similarly to B_4C as a boron source, one of ordinary skill in the art would expect that the resistivity of VGCF would be small, even if the heat treatment of more than 2,000℃ is conducted with BN as a boron source. See Comparative Example 2 of the present specification.

Therefore, in the present invention, it is essential to conduct the heat treatment under the presence of a nitrogen compound containing a boron compound and N_2. As pointed out above, just adding BN without N_2 does not result in a BN coating.

In view of the above, applicants submit that Nishimura et al do not disclose or suggest the subject matter of the present claims.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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